

NIH MedlinePlus

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MAGAZINE

IN THIS ISSUE

Explore the connection
between your brain and
your memories

Apply these science-
based tips to keep you
healthy, happy, and
independent

Ibram X. Kendi:
Fighting a battle with
colorectal cancer



MEET NIH DIRECTORS

Dr. Richard J. Hodes, NIA
Dr. Bruce J. Tromberg, NIBIB
Dr. Michael F. Chiang, NEI

COVER STORY

Actress and singer **Kristin Chenoweth**
wants to put migraine awareness center stage

MIGRAINE



In this issue

WELCOME TO VOLUME 17, ISSUE 2 OF NIH MEDLINEPLUS MAGAZINE.

This issue includes articles featuring migraine, colorectal cancer, healthy aging, and research on our brains and memory. It also includes interviews with celebrities who share their own health experiences and with NIH Directors about the work they and their teams do every day.

Struggling with migraines? Actor, singer, and Tony Award winner Kristin Chenoweth, shares her experience living with chronic migraine, how she was first diagnosed, and how she advocates for others dealing with the condition.

Author and historian Ibram X. Kendi, Ph.D., talks about undergoing treatment for late-stage colorectal cancer while writing his most influential book, *How to Be an Antiracist*. He discusses his journey and how to help others cope with their own cancer diagnoses.

Our “Meet the Director” series features interviews with directors from across NIH. This quarter, we sat down with Michael Chiang, M.D., from the National Eye Institute; Richard Hodes, M.D., from the



National Institute on Aging; and Bruce Tromberg, Ph.D., from the National Institute of Biomedical Imaging and Bioengineering.

Interested in healthy ways to enjoy aging? In this issue, we provide science-based tips for caring for your body, mind, and relationships no matter your age. NIA also offers a few ideas for keeping you connected with your friends and family and for combating social isolation and loneliness.

Have you ever wondered how your brain thinks? New research funded by the NIH BRAIN® Initiative explains how we organize and store memories. NIH MedlinePlus Magazine set out to learn about these findings and more. ■

NIH MedlinePlus MAGAZINE

WHO WE ARE

The National Institutes of Health (NIH) is the **nation's premier medical research agency**, with 27 different Institutes and Centers. The National Library of Medicine (NLM) at NIH is a leader in biomedical informatics and data science research and the world's largest medical library.

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Learn about NIH intramural research on the *Speaking of Science* podcast

➔ **CURIOUS ABOUT WHAT HAPPENS** at the largest biomedical research institution on earth? Learn about it through an exciting podcast called *Speaking of Science*!

The Intramural Research Program (IRP) is NIH's internal research program and the largest biomedical research institution in the world. From research labs to patients' bedsides, IRP researchers advance biomedicine with the goal of improving health, reducing illness, and saving lives.

In the IRP's *Speaking of Science* podcast, you'll hear directly from scientists and clinicians across NIH Institutes and Centers who are tackling fascinating questions and challenges in biomedicine. Each *Speaking of Science* episode features a conversation with a different IRP researcher on topics such as:

- [Molecular “transformers”](#)— a class of proteins that could change the way we understand diseases like cancer, autoimmune disorders, and Alzheimer's disease
- [Why healthy volunteers are the unsung heroes of mental health research](#) and why we need a shared understanding of what it means to be “healthy” to conduct safe, efficient, reliable research
- [How dog genetics could unlock insights into health and diseases](#) among our four-legged friends and their two-legged caregivers



Tune in to *Speaking of Science* [on the IRP website](#) or on your favorite podcast app.

Kristin Chenoweth

wants to put
migraine awareness
center stage



*The Tony Award
winner lets others with
the condition know
they're not alone*



Actress and singer Kristin Chenoweth has thrilled audiences around the globe for decades. The Tony Award winner is perhaps best known for her role as Glinda in the hit Broadway musical *Wicked*. Chenoweth is also one of the millions of Americans who suffer from migraine, an often debilitating form of recurring headaches. She recently shared with NIH MedlinePlus Magazine her experiences living with chronic migraine and as an advocate for others with the condition.



Tell us about your first migraine attack.

I had my first migraine attack at just 25 years old in the middle of my performance with the Virginia Symphony Orchestra. At first, I thought something must be wrong with the spotlight. I started getting what I now call “kaleidoscope eyes,” meaning I saw flashes of light and couldn’t see clearly. I also got what felt like a brain freeze, like when you drink a slushie too fast, and the music sounded like it had been turned way up.

I muscled through until intermission, at which point I fell to my knees and vomited on stage. My head was pounding. I spent the whole intermission worrying about how I would get through the final 45 minutes of the concert. I somehow found it in myself to perform, and as soon as the curtain dropped, I collapsed. A doctor met me backstage and said, “You’re having a migraine attack.” I didn’t know where to go from there. I was confused, worried, and scared this would end my career.

Did you get a particular type of migraine diagnosis?

As my migraine attacks became more frequent following that Virginia Symphony performance, I received my official chronic migraine diagnosis, meaning I was having 15 or more headache days a month, each lasting four or more hours.

What can trigger your migraine attacks?

My triggers include stress, flying, working too many hours, and diet. Bright lights can also be a trigger.

FAST FACTS

Fermented foods such as aged cheeses, pickled foods, and alcohol are a common trigger for those who suffer from migraine attacks.

SOURCE: MedlinePlus

“I was struggling with a migraine attack the night I won my first Emmy Award.”

– Kristin Chenoweth

In what ways have migraine attacks impacted your life and career?

There have been times when I wasn’t able to do what I love because of a migraine attack. As a performer, I’m always thinking about that little girl in the audience who is in New York City to see a Broadway show for the first time. She deserves my 100%, and I feel guilty if I am not able to give that to her.

I was struggling with a migraine attack the night I won my first Emmy Award. I couldn’t even celebrate because taking pictures and socializing was just too much. The last thing you want to do is let down your friends, family, and colleagues, but for many people with chronic migraine, that’s just the reality.

You never know when a migraine attack will strike, and that uncertainty can stop us from making plans. Wouldn’t it be nice if we could just schedule out our migraine attacks? Unfortunately, it doesn’t work like that—once you’re in an attack, you’re in it. For many people living with chronic migraine, it can be devastating to miss work and important life events because of this disease.

“You never know when a migraine attack will strike.”

– Kristin Chenoweth



Left, Kristin Chenoweth won't let migraine attacks dim her light.
Right, Chenoweth sings with the Tabernacle Choir at a holiday special at Temple Square.

“It’s so important to find a doctor that you can be open and honest with, listens carefully to your needs, and is willing to work with you to find a treatment plan.”

– Kristin Chenoweth

How do you manage your migraine symptoms?

Over the years, I have worked closely with my doctor to manage my chronic migraine with a treatment plan that works for me, including Botox injections for the treatment of chronic migraine. I also avoid alcohol and eat a low-sodium diet. And because bright lights are a trigger for me, I wear sunglasses everywhere. It may look funny, but it helps!

What message do you have for others who live with migraine attacks?

It’s so important to find a doctor that you can be open and honest with, listens carefully to your needs, and is willing to work with you to find a treatment plan. I want people living with chronic migraine to know you are not alone.

I know how debilitating chronic migraine can be. That’s why I am so passionate about helping others learn about this disease. In recognition of National Migraine & Headache Awareness Month in June, I partnered with AbbVie to kick off the Center Stage with Chronic Migraine

program,* which aims to empower people living with chronic migraine to talk to a doctor about how to manage their disease.

What professional projects are you working on?

I am in production for Season 2 of *Schmigadoon!* on Apple TV+ where I reprise my role as Mildred. I also have a new docuseries out on Hulu called *Keeper of the Ashes: The Oklahoma Girl Scout Murders*. This summer I came back for Broadway Bootcamp in my home state of Oklahoma where I worked with Kenny Ortega and Broadway professionals to help inspire and collaborate with students who are interested in the performing arts. I am also excited about my first picture book, *What Will I Do with My Love Today*, which just came out, and another fun book, *I’m No Philosopher, But I Got Thoughts: Mini-Meditations for Saints, Sinners, and the Rest of Us*, that I’m releasing shortly. And I am always working on music and performing at shows across the country. ■

*NIH was not involved in the creation of the project, and reference to it does not constitute or imply endorsement by any federal agency.

When migraine turns



chronic

Migraine is a leading cause of disability in the United States. For a subset of people who have it, migraine can develop into a chronic condition, causing even more frequent pain, discomfort, and disruption to daily life.

What is chronic migraine?

Migraine attacks are headaches with migraine characteristics (such as dizziness, nausea, and intense pain that gets worse with activity) that last 4 to 72 hours. Chronic migraine develops over time as these headaches become increasingly frequent. Chronic migraine is defined as a history of 15 or more headache days a month, at least eight of which have migraine characteristics, for at least three months (though for many people with chronic migraine, the number of headache days fluctuates from month to month).

How does migraine become chronic?

Factors that can make it more likely for migraine to become chronic include:

- Ineffective treatment
- Overuse of certain medications (for migraine and other conditions)
- Certain medical conditions (such as anxiety, sleep disorders, and chronic pain conditions)
- Stressful life events

Did you know?

In 2010, the Food and Drug Administration (FDA) approved the **first treatment specifically for chronic migraine**.

Botulinum toxin A, an injectable treatment best known for smoothing wrinkles and fine lines, remains one of the few FDA-approved treatments for adults with chronic migraine.

What is the impact?

Migraine can interfere with work, school, and social life, but chronic migraine makes it even harder to participate in activities and to maintain relationships with friends and family. People with chronic migraine are also more likely to have other health conditions such as chronic pain, arthritis, and depression.

What is the outlook?

There's no cure for migraine or for chronic migraine, but there are ways to find relief. It's important for people with chronic migraine to:

- Work with a health care professional to find the right approach
- Address symptoms as soon as they appear
- Identify migraine triggers and avoid them

With the right treatment plan, many people with chronic migraine can have a better quality of life with fewer and less severe symptoms. ■

About **7.7%** of all people diagnosed with migraine have chronic migraine.

SOURCE: THE AMERICAN MIGRAINE PREVALENCE AND PREVENTION STUDY

Features of migraine and chronic migraine

MIGRAINE

0 to 14

Headache frequency

0 to 14 days per month

Diagnosis

At least 5 migraine attacks over the course of a lifetime

CHRONIC MIGRAINE

15 or more

Headache frequency

15 or more days per month

Diagnosis

A history of 15 or more headache days a month, at least 8 with migraine characteristics, for at least 3 months

MIGRAINE SYMPTOMS AND CHARACTERISTICS

- Headache pain on one side
- Pulsating feeling
- Moderate to severe pain intensity
- Pain that gets worse with physical activity
- Nausea and/or vomiting
- Sensitivity to lights, sounds, or smells

SOURCE: International Classification of Headache Disorders, 3rd edition

Migraine: What you need to know



Anyone can have migraine, including children. Women are three times more likely than men to experience migraine.

Migraine is a neurological condition that is associated with severe headaches and other symptoms in the nervous system and body. Migraine headaches can be very intense, often causing pain that throbs and pulses. Headaches aren't the only symptom that can affect people with migraine: Unlike other kinds of headaches (for example, tension and sinus headaches), they often come with other symptoms such as nausea, vomiting, and dizziness.

Migraine is common—about 12% of Americans have this condition. Migraine attacks happen in several stages, and untreated attacks usually last between 4 and 72 hours. They can be debilitating and may interfere with all areas of life: home, work, school, and beyond.

Symptoms

Migraine symptoms are different for different people. Some common symptoms include:

- Headache (often on one side of the head, but sometimes on both sides)
- Pain that gets worse when you move
- Nausea and sometimes vomiting
- Being unusually sensitive to light, sounds, and smells
- Feeling weak or dizzy

The two most common types of migraine are:

- **Migraine with aura.** Migraine auras can include changes to your visual field such as flashing lights, zigzag lines, or blind spots, as well as nonvisual symptoms such as brain fog, a numb or tingling sensation, or changes to your senses of smell, taste, and touch.
- **Migraine without aura.** Migraine without aura is the most common type. In these kinds of migraine attacks, you won't experience aura but will have other migraine symptoms (for example, headache and nausea).

Causes

We don't know exactly what causes migraine, but genes probably play a big role—most people with migraine have a family member who also has it.

Some people with migraine have different triggers. Common ones include:

- Stress and anxiety
- Certain foods and beverages
- Changes in hormone levels
- Not getting enough sleep
- Skipping meals
- Sudden weather changes
- Medication overuse, which can be caused by long-term use of certain over-the-counter and prescription medications

Who can have migraine?

Anyone can have migraine, including children. Women are three times more likely than men to experience it.

Most people with migraine:

- Have their first attack before age 40
 - Have a family member who also has migraine
- People with medical diagnoses such as depression, anxiety, sleep disorders, and epilepsy may also be more likely to have migraine.

Diagnosis

Talk to your doctor if you're having migraine-like symptoms. Your doctor will ask about your symptoms, your medical history, and your family's health history. They may do some tests to find out whether the headaches have a cause other than migraine (like a sinus infection, muscle tension, or another medical disorder).

There is no cure for migraine, but there are pharmacological (drug-based) and nonpharmacological ways to make living with migraine easier.

Prevention

Sometimes migraine attacks can be prevented before they happen with a combination of medications and [lifestyle changes](#).

Talk to your doctor about medications and therapies to prevent migraine attacks. Your doctor might recommend migraine-specific medications or antidepressants, blood pressure medicines, and antiseizure medicines. These are usually medicines that you need to take every day. Your doctor may also suggest certain vitamins or minerals that might help.

Keep a migraine diary. Knowing your triggers is a first step to learning how to cope with migraine. Use a diary to keep track of when you're having migraine attacks and what's happening around that time to identify your personal triggers. When you have a migraine attack, write down:

- When the pain started (date and time)
- What you were doing when the pain started
- What you ate and drank in the 24 hours before the attack
- How many hours you slept the previous night
- The symptoms you had during the attack
- What you did during the attack, including any medicines you took
- When the pain stopped

Treatment

Treating symptoms as soon as you feel an attack coming on can keep them from getting worse. Your doctor can help you find a treatment—or a combination of treatments—that works for you.

- **Over-the-counter pain relievers** such as ibuprofen, acetaminophen, and aspirin can help with milder symptoms.
 - **Prescription medicines**, including medications that relieve or prevent migraine symptoms, may also be used to address migraine. The most common classes of drugs are called “triptans” and “CGRP antagonists” (CGRP stands for calcitonin gene-related peptide). These drugs come in different forms such as nasal sprays, dissolvable tablets, and shots.
 - **Medical devices** such as peripheral nerve and vagus nerve stimulators can help treat migraine by targeting the nerves that contribute to migraine symptoms. Be aware that taking medications too frequently (more than twice a week) can make migraine worse. You can also get relief during an attack by:
 - Resting in a quiet, dark room
 - Closing your eyes
 - Cooling your forehead with a wet cloth or an ice pack
 - Drinking lots of liquids
- With the right combination of prevention and treatment, most people can find some relief. ■

By the numbers



1 billion—Estimated number of people worldwide who experience migraine

1 in 5 women have migraine



1 in 16 men have migraine

1 in 11 children have migraine



SOURCES: American Headache Society, and American Migraine Foundation

10 common migraine triggers and how to cope with them

If you live with migraine, one of the best things that you can do is identify your personal triggers. You can't always avoid triggers, but understanding what they are and how they affect you is the first step to finding relief. Once you've isolated the trigger, you can try a coping strategy.

1) Stress. Stress is one of the most common triggers among people with migraine.

How to cope: Unfortunately, stress isn't always avoidable, but stress-relieving activities such as exercise, meditation, or yoga can help. Therapy can also help you learn new strategies for coping with stress; if you aren't currently working with a therapist, ask your primary care doctor for a referral.

2) Hormones. Changes in hormones over the menstrual cycle and during pregnancy can trigger migraine attacks for some people.

How to cope: If you think there's a link between your migraine attacks and your hormones, bring it up with your doctor. Some people get migraine relief with hormonal treatments such as birth control and hormone replacement therapy.

3) What you eat. Fermented or pickled foods, aged cheeses, and processed or cured meats (like hot dogs and lunch meats) can all be triggers, and so can some preservatives that are found in many foods.

How to cope: Talk with your doctor about your trigger foods. If you know what they are, consider removing them from your diet (or cutting down on them). If you're not sure, ask your doctor about trying an elimination diet (an eating plan that removes all the foods or food groups that could impact your migraine attacks). Cutting all the suspected culprits out of your diet for a few weeks, then reintroducing them one at a time, can help narrow down which foods are likely to be triggers.

You could also try eating new foods. According to NIH research, [diets that are low in vegetable oils and high in fatty acids \(such as those found in fish\) may help control migraine](#).



Common migraine triggers include stress, hormones, some food and drink, and lack of sleep.

4) When you eat. Eating meals at different times of day or skipping a meal may also trigger migraine attacks or make them worse.

How to cope: Eat at the same time every day and try not to skip meals.

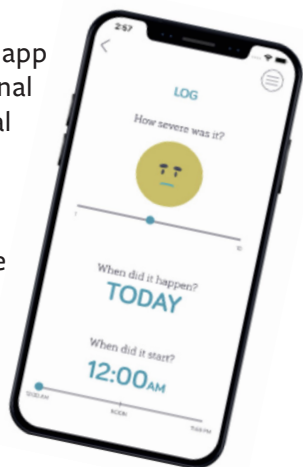
5) What you drink. Alcoholic beverages—especially wine—can trigger migraine attacks in some people. Too much coffee and even caffeine withdrawal can also be a trigger.

How to cope: Alcohol and coffee can dehydrate the body, which can trigger migraine attacks or make them worse. Try avoiding alcohol and gradually reducing your caffeine intake. Stay hydrated, practice moderation, and know your personal limits.

6) The weather. Sudden changes in the weather such as temperature, atmospheric pressure, and even seasonal changes can all trigger migraine attacks.

How to cope: Keep an eye on the weather forecast and try to avoid your other triggers, especially when a big weather change is coming. If you get lots of migraines when it's hot outside, stay inside where it's cool, and try to hydrate by drinking plenty of liquids (always a good idea).

Migraine Trainer® is an app developed by the National Institute of Neurological Disorders and Stroke (NINDS) to help teens understand possible causes of their migraine attacks and create an individual migraine management plan with their parents and health care providers.



7) Your sleep. Not getting enough sleep or sleeping too much can be a migraine trigger. A serious medical condition called [sleep apnea](#) is also associated with migraine.

How to cope: Try to get between seven and nine hours of sleep each night and talk to your doctor if you have concerns about your sleep or think you might have sleep apnea.

8) Your environment. Bright lights, loud noises, and strong smells can all be triggers, and they can make symptoms worse during an attack.

How to cope: Avoid or reduce your exposure to these triggers when you can and ask the people around you to help. Ask your office mate to leave their perfume or cologne at home, block bright outdoor light with dark sunglasses, and try wearing earplugs or noise-canceling headphones to muffle loud sounds.

9) Medication overuse. Some medications, including ones used to treat migraine, can cause or worsen migraine symptoms if you take them too often.

How to cope: Make sure you know the recommended dose and frequency for any medications you're taking. If a medication you take is causing an increase in your migraine attacks, talk with your doctor about switching to a different drug.

10) Smoking and tobacco. The nicotine in cigarettes and e-cigarettes constricts blood vessels in your brain by making them narrower and tighter, which can trigger migraine attacks.

How to cope: If you smoke or use tobacco products, [make a plan to quit](#). If you don't use tobacco products, it's always a good idea to stay away from secondhand smoke. ■

What are the different phases of a migraine attack?

There are up to four phases of a migraine attack, but not everyone who experiences migraine goes through all of these stages.



Prodrome

This phase (also called the “premonitory phase”) usually starts about a day before the attack starts. During prodrome, you might notice changes alerting you that a migraine is coming. These changes can include:

- Unexplained mood changes
- Feeling more sensitive to light, sounds, or smells
- Craving certain foods
- Yawning repeatedly
- Increased thirst and urination



Aura

This phase can happen just before or during a migraine headache. Symptoms of aura are usually visual, and you might see flashing or bright lights or zig-zag lines. You might also have nonvisual symptoms like weak muscles, difficulty speaking, or numbness in part of your body.



Headache

During this phase, you might feel throbbing or pulsing pain on one or both sides of your head. The pain usually starts slowly and then becomes more intense, and it can get worse when you move, cough, or sneeze. You might feel extra sensitive to light, sounds, and smells. Many people feel nauseous during this phase and sometimes vomit. Some people have migraine attacks without a headache but can still experience other migraine symptoms.



Postdrome

This phase (sometimes called a “migraine hangover”) comes after the headache and can last for a day or two. You may feel drained, weak, and confused, and you might also have some lingering migraine symptoms.

“Something may have happened to you this morning... and that memory might very well last a lifetime. It has permanently modified you.”

—Dr. Ueli Rutishauser

The clip for a soft boundary might look like footage of a baseball game cutting from the batter hitting the ball to the fielder catching that ball—it’s two separate images from the same event. A clip for a hard boundary would be that baseball game cutting to a commercial—two entirely separate events.

Findings

When patients reacted to the cuts in the footage they were watching, researchers noticed two groups of cells activated more consistently: “Boundary” cells were activated by both soft and hard boundaries, and “event” cells were activated only by hard boundaries. The team believes hard boundaries activate both boundary and event cells and are what trigger the brain to create a new memory.

“A finding like this is exceptionally rare because looking inside the human brain at the resolution we were able to is so rarely possible,” says Dr. Rutishauser. “That’s one of the main reasons why we know so little about how human memory works. This study was a really precious opportunity, and it was striking that we found these boundary cells behaving so consistently.”

Possible treatments

Now that we know what cells are involved in memory production, Dr. Rutishauser says the next step is to figure out what activates the cells. Figuring that out could have a huge effect on treating memory-related issues like Alzheimer’s disease and dementia.

The team plans to try to answer that question by looking at dopamine and the brain’s theta rhythm. Dopamine—a neurotransmitter that plays a role in pleasure and learning—might be involved in the activation of boundary and event cells, and the theta rhythm—the brain’s normal internal rhythm that affects learning and memory—could be the essential beat at which the boundary and event cells need to fire. ■



Other exciting brain and memory studies

NIH is funding several studies across the country related to the brain and memory. Here are just a few:

Study of the Brain, Thinking, and Memory

This study is looking for participants from the Washington, DC, metro region. Its goal is to gain a better understanding of how the brain, thinking, and memory works in people with and without autism spectrum disorders. Researchers are looking for individuals between 18 and 35 years old who have a bad memory for faces. [Learn more about this study.](#)

Memories and How the Brain Works

This study is looking for participants from the Washington, DC, metro region. One of the goals of this study is to evaluate how the brain activates and represents memories. Participants will undergo an MRI brain scan and a magnetoencephalography (MEG) scan while watching videos created in an app called “1 Second Everyday,” which uses one-second video snippets to create a longer “memory” video. [Learn more about this study.](#)

Brain Circuits Susceptible to Aging, Alzheimer’s Disease

NIH has awarded a grant to researchers from the University of California, Irvine, to create maps of the brain that identify specific brain cells and circuits related to aging and Alzheimer’s disease. These findings can hopefully lead to earlier diagnoses and help create new treatments. [Find out more about this research.](#)

Seattle Alzheimer’s Disease Brain Cell Atlas Project

The Seattle Alzheimer’s Disease Brain Cell Atlas consortium, led by the Allen Institute, is attempting to create a cellular- and molecular-level atlas of the human brain to determine the causes and effects of Alzheimer’s disease. The project is a National Institute on Aging-funded collaboration and relies heavily on brain-mapping technology developed by researchers funded by the NIH BRAIN Initiative. [Read about this work.](#)

Dr. Ibram X. Kendi advocates vigilance after experiencing colorectal cancer

*The antiracism author and historian
describes his recovery from the disease*

Best-selling author Dr. Ibram X. Kendi has battled colorectal cancer.



Author and historian Ibram X. Kendi, Ph.D., has won many accolades. His book *How to Be an Antiracist* reached #1 on the *New York Times* Best Sellers list, and he's been awarded the MacArthur Fellowship, the W.E.B. Du Bois Book Prize from the Northeast Black Studies Association, and the National Book Award. At age 35, Dr. Kendi was diagnosed with stage 4 colorectal cancer, a disease that disproportionately affects African Americans.

The scholar of African American studies penned his most influential work while undergoing treatment for late-stage colorectal cancer. He spoke with NIH MedlinePlus Magazine about his journey and how he is doing nearly five years after his diagnosis.

Did you have symptoms before being diagnosed with cancer?

Yes. In the fall of 2017, I started to have some symptoms. I had to go to the bathroom almost every hour. And while I didn't recognize it at the time, I was also losing weight. During the Thanksgiving weekend, I started to have what I thought was a stomach virus. I started having bloody diarrhea, and then the blood did not stop even after my stomach issues resolved. By New Year's Day, I realized it

couldn't be ignored. I went to get a colonoscopy in early January. They told [me and my wife] they found a mass and, after further imaging, found that it had spread. That is when they told me I had stage 4 colorectal cancer.

What was your reaction when you received the diagnosis?

When I was first told by the doctor that she had found a mass and it was likely cancerous, I was shocked. I didn't have any other risk factors, and I was only 35. And then to find out that it had spread, and it was stage 4, which just 12% to 14% of people survive...it was just devastating.

What was your course of treatment, and how are you doing now?

They put me on a strong regimen of chemotherapy. I had to take pills every day, and I also received infusions every few weeks. That was very difficult to endure. I had some very difficult side effects. The most significant one was an extreme sensitivity to cold. And I started chemotherapy in January, in the middle of winter. I could not even breathe in cold air without it hurting. Drinking anything cold hurt my throat. I had tingling in my fingers and toes, and they started getting black, extremely dry, and blistered. So I had

“Continuing to put focus on other things can help you get through treatment. I wrote most of my book *How to Be an Antiracist* when I was going through treatment.”

— Dr. Ibram X. Kendi

to figure out ways to manage that. It was a constant battle of trying to just endure the six months of chemotherapy and additional surgery in August.

The good news is that when the surgeons went in the second time, they found that I had a complete response from the chemotherapy and said I had a good prognosis going forward. I had a good chance of being one of the 12% of survivors.

Your wife had breast cancer not long before your diagnosis. How did that affect how you dealt with your diagnosis, treatment, and recovery?

In many ways it prepared us to know how to handle the process of someone having cancer. For me, it was much easier to endure having cancer than it was caring for someone else with cancer. I also realized that my wife struggled with how people would act around her when they found out she had cancer, so we decided not to tell many people I had cancer. That helped me as I didn't have to deal with the discomfort of people's reactions.



Dr. Ibram X. Kendi greets a young fan at a bookstore.

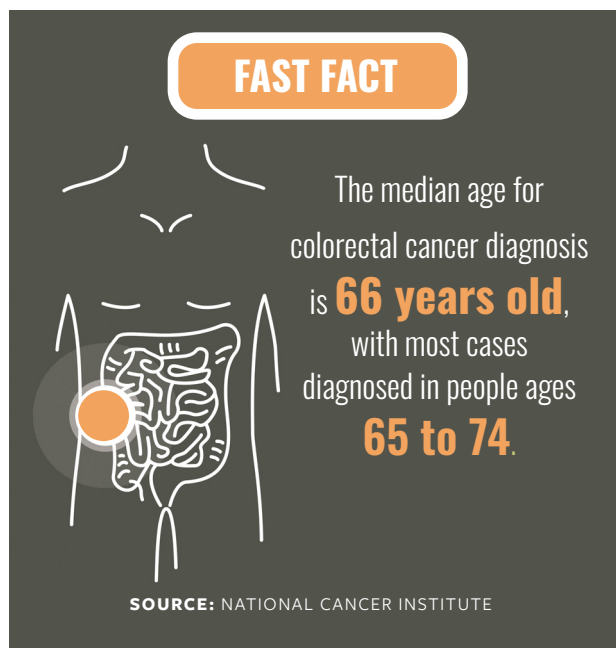
Could you speak to the importance of family and loved ones in your cancer treatment and recovery?

Dealing with cancer is extremely chaotic and difficult. When you have a support system that is not chaotic, it can be so helpful to you and your battle to survive. Your family and others can help get your mind off the illness and support you.

What is your message to others based on your experience?

For people who do not have colon cancer, please be aware of the symptoms. Be vigilant about your body. I certainly wish I had gone in earlier to be checked. There is a chance my cancer might have been found at an earlier stage.

For those who do have cancer, continuing to put focus on other things can help you get through treatment. I wrote most of my book *How to Be an Antiracist* when I was going through treatment. It gave me something to focus on and to look forward to. It was very helpful that the entirety of my focus at the time wasn't on the cancer. ■



Calling out colorectal cancer

How to check for this disease and what to expect if you have it

Colorectal cancer is the third leading cause of cancer-related deaths among men and women in the United States, with 151,030 new cases estimated to have occurred in 2022. “Colorectal cancer” can refer to any cancer that forms in the tissue that lines the inside of the colon or rectum. While some people are at higher risk than others, anyone can get colorectal cancer. Screening is important to detect the disease and remove precancerous polyps before they become cancerous.

What are the symptoms of colorectal cancer?

The following symptoms can be caused by other conditions, but people experiencing them should consult their doctor:

- Diarrhea or constipation
- A feeling that your bowel does not empty completely
- Blood in your stool
- Stools that are narrower than usual
- Frequent gas pains or cramps
- Frequently feeling full or bloated
- Weight loss with no known reason
- Fatigue
- Nausea or vomiting

Who is at risk for colorectal cancer?

While anyone can get colorectal cancer, the [National Cancer Institute](#) (NCI) reports that slightly more than 1 in 25 men and women will develop colorectal cancer in their lifetime.

People who have had colorectal cancer in the past or who have had certain kinds of colorectal polyps removed are at greater risk for developing colorectal cancer, as are those with a family history of the disease. People with Lynch syndrome or familial adenomatous polyposis, both of which are inherited conditions, or who have a history of inflammatory bowel disease such as ulcerative colitis or Crohn’s disease are also at higher risk.

Some lifestyle factors associated with increased risk include excessive alcohol consumption, obesity, smoking, and possibly diet.



Rates of colorectal cancer are also higher for Black people and non-Hispanic American Indians/Alaska Natives than any other racial or ethnic groups.

As you get older, your risk increases. The U.S. Preventive Services Task Force recommends colorectal cancer screening for adults ages 45 to 75 of average risk. Screening for patients ages 76 to 85 is recommended for select individuals. Colorectal cancer is still rare among adults younger than 50, but these rates are increasing. You should consult your doctor about screening methods and frequency.

How is colorectal cancer screened?

Colorectal cancer is detected using a range of procedures, some invasive and some not. These include colonoscopies, stool tests, and sigmoidoscopies. Abnormalities, including lesions or polyps found during a screening, will be tested for cancer. A new approach is to check blood samples for genetic material that polyps or tumors may release into the bloodstream.

By the numbers

1.37 million	People living with colorectal cancer in the United States in 2019
\$1.46 billion	The national out-of-pocket cost for colorectal cancer in 2019
66 years old	The median age people are diagnosed with colorectal cancer
151,030	Estimated new cases of colorectal cancer in 2022
52,580	Estimated deaths from colorectal cancer in 2022

How is colorectal cancer treated?

Treatment for colorectal cancer depends on the type and stage of a person's disease and may be combined. Standard treatments include:

- **Surgery.** This can be to remove polyps, cancer, or part or all of the colon or rectum depending on the cancer's spread and stage.
- **Chemotherapy.** Powerful chemicals administered intravenously (with an IV) or orally (swallowing capsules or pills) kill fast-growing cancer cells in the body.
- **Targeted therapy.** A drug delivered intravenously or orally targets the proteins that control how cancer cells grow, divide, and spread.
- **Radiofrequency ablation.** A probe inserted into the body emits radiofrequency waves to the tissue around a growth. The cells in that tissue die and the immune system removes them, which causes the growth to shrink.
- **Cryosurgery.** Liquid nitrogen applied to the growth freezes its cells, causing them to die and to be absorbed into the body.
- **Radiation therapy.** High doses of radiation damage cancer cells' DNA, causing them to die over time.
- **Immunotherapy.** This treatment harnesses the body's immune system to control and eliminate cancer. Drugs are usually administered intravenously.

If your doctor finds colorectal cancer, they may recommend more tests to see whether the disease has spread to other parts of the body. Colorectal cancer can spread through tissue, the lymph system (organs that help fight infections and move fluid through the body), or the blood. This development is called *metastatic cancer* and is the most advanced stage.

NCI has several resources available, including a list of questions you may want to ask your doctor if they recommend treatment for colorectal cancer. It's important to talk to your doctor about not only what will happen

Some questions to ask your doctor about colorectal cancer treatment

- What stage is my cancer, and what are the treatment options available to me?
- Is there a [clinical trial](#) for my cancer treatment that would be right for me?
- When do I need to begin treatment, and how long will it last?
- How can I find a specialist for my treatment?
- Can you help me find a doctor to give me a second opinion about my treatment options?
- What happens during the treatment?
- What are possible side effects of my treatment, and are any of those side effects serious?
- Do I need to tell you about any medicines or dietary supplements that I am taking, and could they affect my cancer treatment?

Find more suggested questions [here](#).

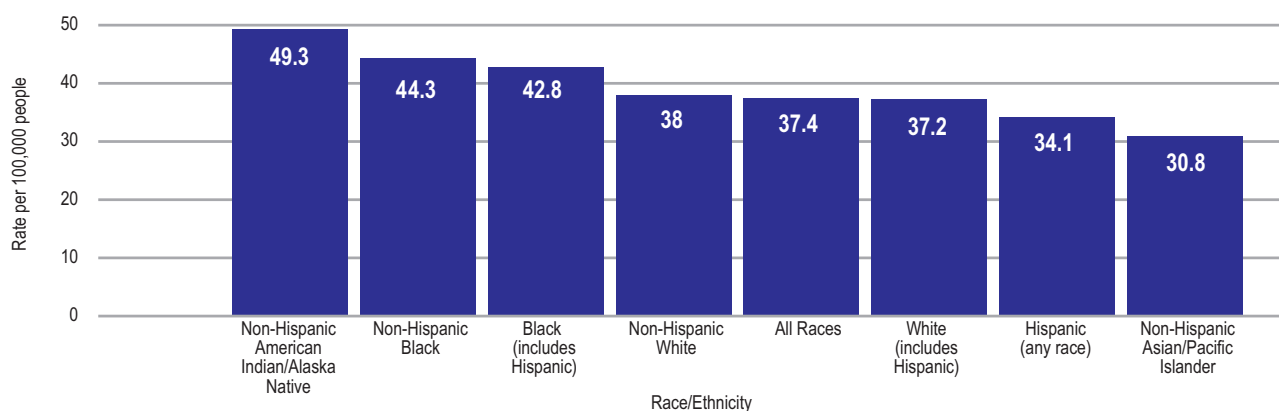
during the treatment itself but possible side effects and how any other medications, dietary supplements, or drugs you may be taking could affect the treatment.

Remember that colorectal cancer can come back even after being treated. It's important to continue the screenings your doctor recommends so they can restart treatment if the disease returns.

Coping with colorectal cancer

If you or a loved one are diagnosed with colorectal cancer, you are not alone! [NCI](#) has information for both patients and caregivers about managing and recovering from colorectal cancer, including questions to ask your doctor and how to connect with support groups. ■

Colorectal cancer rates by race/ethnicity (2019)



SOURCE: NATIONAL CANCER INSTITUTE



Current NCI research on colorectal cancer

Several projects are underway with support from the National Cancer Institute, including:

The ACCSIS program

As part of the [Cancer MoonshotSM](#), the ACCSIS (Accelerating Colorectal Cancer Screening and follow-up through Implementation Science) program comprises eight research projects to increase the rates of colorectal cancer screenings, follow-ups, and referrals to care. ACCSIS has a special focus on racial and ethnic minority populations, rural communities and difficult-to-reach areas, and other underserved groups. [Read more about the ACCSIS project.](#)

FORTE Colorectal Cancer Prevention Trial

People ages 50 to 69 who have had one or two small, noncancerous polyps completely removed during a colonoscopy within the past four years may qualify to participate in the FORTE (Five- or Ten-Year Colonoscopy for 1-2 Non-Advanced Adenomatous Polyps) study. This research aims to help determine how long such people can wait for a follow-up screening after a routine colonoscopy. [Read more about this study.](#)

COMMIT study for colorectal cancer treatment

COMMIT (Combination Chemotherapy, Bevacizumab, and/or Atezolizumab in Treating Patients with Deficient DNA Mismatch Repair Metastatic Colorectal Cancer) is a nationwide study that looks at a combination of treatments for people with metastatic colorectal cancers whose tumors are deficient in DNA mismatch repair. [Read more about this study,](#) including eligibility requirements for participating.

Colorectal cancer screening: What to expect

Screening for colorectal cancer is crucial for identifying malignant (cancerous) and benign (noncancerous) growths—which could still turn cancerous—as early as possible. The U.S. Preventive Services Task Force recommends adults ages 45 to 75 of average risk get screened for colorectal cancer. Patients should consult their doctors about the most appropriate screening method based on their age, medical and family histories, current overall health, cost and follow-up care, and other factors. The most common screening methods for colorectal cancer are:

Stool tests. The patient uses a kit to take a stool sample at home. They return the kit to the doctor to test for tiny amounts of blood that may not be seen with the naked eye. If the findings are positive, the doctor will usually recommend a colonoscopy.

 Sometimes  Every 1 to 3 years




Colonoscopy. The doctor inserts a [colonoscope](#)—a flexible tube with a light and lens for viewing the colon and a tool for removing tissue—through the anus into the rectum and colon, and air is pumped into the colon to expand it so that the doctor can see the entire colon lining more clearly. The doctor can remove abnormal growths during this procedure, which are analyzed for cancer.

    Every 10 years



Virtual Colonoscopy. X-ray images are digitally assembled to create 3D images of the colon and rectum. If the doctor finds abnormal growths, the patient needs a standard colonoscopy to remove them.

  Every 5 years

Sigmoidoscopy. The doctor inserts a [sigmoidoscope](#)—like a colonoscope but shorter—through the anus into the rectum and sigmoid colon (which holds feces until you go to the bathroom) and pumps air into the colon to expand it. The doctor can remove and analyze abnormal growths.

   Every 5 or 10 years if combined with a fecal immunochemical test

KEY

- | | |
|--|---|
|  Change diet/medication before procedure |  Invasive (a device is inserted into the body) |
|  Colon cleansing (cleared of stool) needed before procedure |  Sedated during procedure |
| |  Frequency |

David L. Nash advocates for early detection after living with colon cancer

The former Harlem Globetrotter discusses life after his colon cancer diagnosis



David L. Nash works as the National Library of Medicine's Education and Outreach Liaison.

When David L. Nash isn't sharing stories about his time as a Harlem Globetrotter or serving as the Education and Outreach Liaison for the National Library of Medicine (NLM), he gives back to his community through health and wellness. The former basketball player is known not only for his talent on and off the court, but also for his colon cancer diagnosis. He talked with NIH MedlinePlus Magazine about his experience with colon cancer and how he advocates for early screening.

When were you first diagnosed with colon cancer, and how long were you living with cancer?

I think it was around 2009, and I was in the early stages of colon cancer. I went in for a yearly physical and my doctor did a routine colonoscopy, and that's when he discovered that I had colon cancer. I lived with cancer for about a year without knowing it.

Did you have any signs or symptoms?

I didn't have any signs or symptoms at the time. My doctor was doing a standard colonoscopy, and that's when they discovered polyps in my colon. My doctor tested the polyps and said that I did have colon cancer.

What was your treatment approach?

I remember going through the operational procedures [at the Georgetown Lombardi Comprehensive Cancer Center] in Washington, DC, and I remember it so well. My doctor had to be about 5 feet, 2 inches, and I looked like Frankenstein on the table because I'm 7 feet tall. They had to sterilize a chair and bring it in for the procedure because I was too long for the table.

.....
 "You must **get screened**, you must **get tested**, because you **do not want to wait** too long."

The following treatment approach was to do radiation, and I did radiation at the DeCesaris Cancer Institute in Annapolis, Maryland. I did radiation about twice a week. Fortunately, there was no pain during the radiation, especially since I just had surgery. So, I was doing radiation and taking medication, which was beneficial for me.

What choices do you make to help you stay active and healthy?

I stay away from a lot of red meat. A lot of people enjoy fast food, my grandchildren included. They love fast food and I swear, I spend almost \$100 every time I go. But I eat fruits and vegetables and do a little bit of exercising. I do a little bit of walking, keep it lean and green, but I don't overdo it.

How have your career and experience with colon cancer impacted each other?

I will say, being a basketball player really gets you in the door to talk to people about the importance of health and wellness. People love to hear about basketball, so I often lead with stories of my brief time with the Chicago Bulls or my experience as a Harlem Globetrotter. Eventually, I put that to the side and really discuss the importance of health and wellness.

What is your message to others about early detection and treatment?

Colon cancer is common in the African American community, so I really encourage Black men (as they have a higher chance of developing colon cancer) to get tested because it is curable. You must get screened, you must get tested, because you do not want to wait too long. It becomes difficult to treat if you wait until the last minute. Early detection is key. It is the most curable form of cancer if caught in time, and that is what I want to emphasize.

“I emphasize that **early detection and treatment is key**, and if they find that it’s in your body, you have got to **think positively** about how you’re going to get it out.”

You discovered that colon cancer runs in your family. How do you connect with your family about health and wellness, and how do you encourage early screening with the men in your family?

I had no idea colon cancer runs in my family. At the time of my diagnosis, my doctor and I talked about the genetics of it. I was very fortunate to be speaking at a conference in Little Rock, Arkansas, and while I was there, a few of us from the conference went into the archives of Little Rock and found the generational history of my family. I found out my great grandfather and uncles on my mother’s side also had colon cancer. That’s when I found out that colon cancer runs in my family.

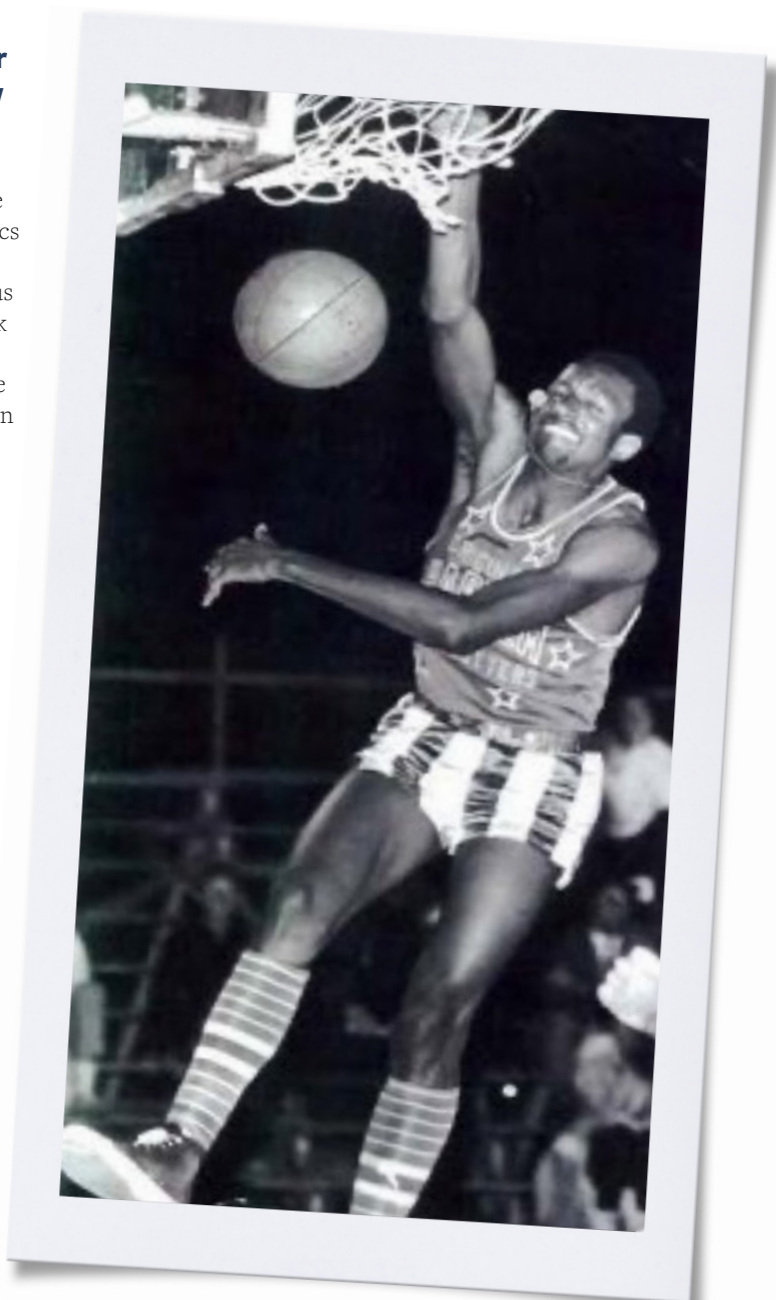
I emphasize that early detection and treatment is key, and if they find that it’s in your body, you have got to think positively about how you’re going to get it out. My father-in-law died from colon cancer when he was about 84 or 85 years old. If the cancer had been detected early, he may have had treatment opportunities. At that age, there wasn’t much that could be done, but he lived a good life and died peacefully.

How do you advocate for health and wellness in your community?

My pastor, Dr. Henry P. Davis, III, and I bring a group of pastors and people together on Sundays to talk about health and how to begin to address it. We then discuss health, and one of the biggest things that we are facing right now is mental health. Mental health is important, especially for our young children. Then we go back and discuss colon cancer, which is one of the most curable cancers if caught early.

In what ways do you connect with the community about colon cancer?

In communities of color, I often find going to churches and other community programs is the best. I take print material from NLM that has information about colon cancer and hand those out. I think they are beneficial, so I take boxes of them out to the community and really talk about it. When I go out and speak about colon cancer, people are often surprised that I am a former cancer patient because colon cancer affects you in a way that you can’t really tell that you have it. When I had cancer, you couldn’t tell—I didn’t lose any weight or anything like that. I was just blessed to have such an amazing medical team at the time. ■



Former Harlem Globetrotter David L. Nash encourages early detection for colon cancer.



POWERED BY NIH EXTRAMURAL FUNDING

SPOTLIGHT ON MICHIGAN

NIH funding powers research and programs that improve health and lead to new scientific findings. While intramural research happens within NIH's labs and clinics, extramural research grants from NIH's Institutes and Centers support programs outside of NIH.

NIH MedlinePlus Magazine explores how this funding is making a difference in communities across the country. This month, we're putting the spotlight on extramural research supported by the [National Library of Medicine \(NLM\)](#). Each year, NLM awards more than 80% of its budget to universities, medical schools, and other research institutions to support research and training in biomedical informatics and data science.

Explore more of NLM's offerings by taking a [virtual tour](#) of the largest biomedical library in the world.

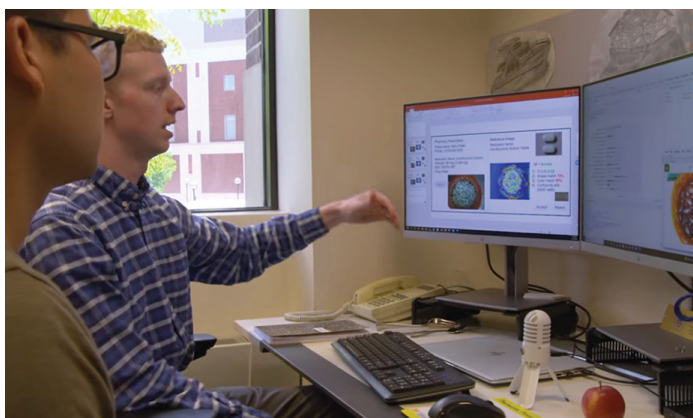
Using machine intelligence to reduce medical errors



Medical errors are a leading cause of death in the United States, and many of these errors involve medications. With

funding from NLM's [Extramural Programs](#), researchers at the [University of Michigan College of Pharmacy](#) are using machine intelligence to accurately identify different medications and help prevent these errors.

Learn how this research helps reduce medication errors by making sure that patients are getting the right pills in the right bottles. ■

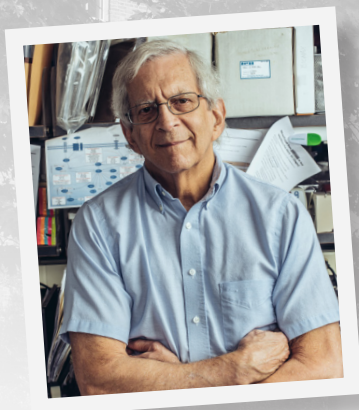


Researchers at the University of Michigan College of Pharmacy use machine intelligence to prevent medication errors.

Meet the Director:



National Institute
on Aging



Richard J. Hodes, M.D.

Richard J. Hodes, M.D., an influential scientist in the field of immunology, has dedicated his career to the science of aging. Dr. Hodes (pronounced “HODE-es”) has been the Director of the NIH National Institute on Aging (NIA) since 1993, where he oversees research on all aspects of the aging process. NIH MedlinePlus Magazine had a chance to chat with Dr. Hodes about the latest in cutting-edge Alzheimer’s disease research, geroscience (which focuses on the intersection of basic aging biology, chronic disease, and health), the importance of diversity in research, how studying dogs can help us learn about—and improve—health and longevity for both humans and our canine friends, and more.

How would you describe the mission and focus of NIA?

NIA conducts research to understand the process of aging and uses what we find to optimize quality of life for people as they grow older. We support development of the research workforce across different areas of aging-related science, from molecular to behavioral to social sciences. We also support and provide structures and resources to facilitate research, and then we communicate the results to the research community, policymakers, the public, and others.

Our [mission](#) and focus still resonate with the original congressional language from the 1970s, but I would also add that there’s been a growing recognition of the importance of diversity in both our workforce and the older populations we serve.

Alzheimer’s disease and related dementias are a key focus for NIA. What kinds of research does NIA support in these areas?

Alzheimer’s disease and related dementias are a major source of distress and disability—there are currently more than 6 million people living with dementia in this country alone. Much of our work is driven by the need for effective interventions, which we don’t yet have.

But we are also driven by the optimism and hope that comes with the remarkable progress and discoveries that we have made. For example, learning which [genetic regions of our DNA](#) are related to Alzheimer’s risk gives us some clues about disease mechanisms that can inform the development of effective interventions. And we’re continuing to learn about the complexity and diversity of factors that contribute to dementia and its symptoms. NIA currently supports over [400 clinical trials on Alzheimer’s and related dementias](#). About half of these are testing dementia care and caregiving interventions, and the other half are looking at pharmacological and nonpharmacological interventions to treat and prevent these diseases.

But these kinds of advances are only possible with the participation of thousands of people in clinical trials and other studies. To discover which interventions and treatments work best and will ultimately improve quality of life, we need volunteers with and without Alzheimer’s disease and related dementias [to participate in research trials](#).

To ensure findings will be relevant for all people, our clinical trials must include participants who reflect the diversity of the U.S. population.



Understanding the basic underlying cellular and molecular mechanisms of the aging process itself could allow us to alter the risk of many of these diseases and conditions associated with aging not just one at a time, but altogether.

How does NIA research address health disparities across the lifespan?

NIA has always emphasized the importance of addressing unique vulnerabilities of older adult populations, and we're committed to addressing the needs of other underserved populations—for example, different racial and ethnic groups, different socioeconomic groups, and people who live in rural versus urban settings.

One way we continue to address issues of health disparities during COVID-19 is through our contributions to the [RADx[®] Underserved Populations \(RADx-UP\) initiative](#). This is a cross-NIH collaboration through which we work to ensure that underserved and vulnerable populations have access to COVID-19 testing.

But our entire research domain encompasses important issues around diversity, health disparities, and health equity. For example, in Alzheimer's disease, there are striking differences in disease outcomes for different populations. Some of our recent research looks at how these differences relate to environmental and social determinants of health as well as genetics. One example of research we're conducting in this area is the [Health and Aging Brain Study - Health Disparities](#), which is a longitudinal study that looks at the risk of cognitive decline, Alzheimer's, and related dementias in African American, Mexican American, and non-Hispanic White populations. The [Health and Retirement Study \(HRS\)](#), which has been happening since the early 1990s, is another example; it was carefully designed to include a representative sample of the U.S. population.

What is the HRS? What questions are researchers trying to answer, and what have they found?

The HRS is a highly interdisciplinary, longitudinal study that looks at what happens to people as they transition into retirement. There are more than 20,000 participants over the age of 50, including people from diverse and historically underrepresented populations.

The goal is to tell the story of aging in America by examining intertwined social, environmental, and biological factors and the relationships between them. One of the ways we do this is by studying relationships between life events and experiences and measurable biological outcomes. For example, we have long known that there

are associations between stressful life experiences and events (such as experiencing discrimination or losing a job), but whether these stresses cause the poorer health outcomes—or how they do so—has been less clear. A [recent HRS study](#), however, found that stress is also associated with changes to a type of white blood cells that are an important part of the immune system process responsible for adapting to new immune challenges. The changes to these cells (called T lymphocytes) are consistent with our immune systems becoming less efficient at meeting certain challenges, which could explain part of the link between stress and health that we have long known about.

Something unique about this project is its commitment to open data sharing—making data accessible and available as soon as possible—from the beginning. This broadens the population of investigators who can come in with new questions and analyze the data to find new answers. HRS has more than 8,000 current registered users and [5,000 papers and publications](#) that cover a wide range of scientific disciplines.

What is geroscience, and why is it important?

[Geroscience](#) is a relatively new term. Aging itself is a risk factor for many chronic diseases and conditions—cancer, diabetes, heart disease. Understanding the basic underlying cellular and molecular mechanisms of the aging process itself could allow us to alter the risk of many of these diseases and conditions associated with aging not just one at a time, but altogether. There is literature that identifies the major parameters or dimensions of aging—things like protein stability, stem cell function, and mitochondrial function. Geroscience studies these processes in animals and in humans to track which diseases those processes are each related to. This will give us a better understanding of those relationships so we can begin exploring ways to intervene and improve health outcomes.

To learn more about the Health and Retirement Study, geroscience, and how Dr. Hodes unwinds from work, check out his full interview online at [NIH MedlinePlus Magazine](#)! ■

Live long, be well:

Science-based tips for healthy aging

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Caring for your body, mind, mental health, and relationships has health benefits no matter your age.

These science-based tips can help you stay healthy, happy, and independent for years to come.



Prioritize your health with tips from the National Institute on Aging.

Get moving

Physical exercise can increase mobility, help prevent falls and fractures, and reduce the risk of some diseases associated with aging. It can also give the brain a boost, which can help with tasks like processing information, learning new things, paying attention, and solving problems.

These kinds of exercise are especially important as you get older:

- **Endurance and aerobic exercises** such as hiking, biking, dancing, and swimming, which strengthen your heart and lungs and boost circulation
 - **Strength exercises** such as weightlifting, resistance band workouts, and carrying groceries, which keep your muscles strong
 - **Balance exercises** such as tai chi and standing on one foot, which help improve coordination and build strength to reduce the risk of falls and fractures
 - **Flexibility exercises and stretches** such as yoga, which can help keep you limber and protect you from injuries
- Experts recommend aiming for 2.5 hours of physical exercise each week, which is only slightly more than 21 minutes per day. [Get more tips for getting \(and staying\) physically active as you age.](#)

Eat healthy

A diet that includes plenty of [nutrients, vitamins, and minerals](#) keeps your brain and body healthy and may reduce your risk of some aging-related diseases.

- **Prioritize nutrient-rich foods** such as seafood, plant-based proteins like nuts and seeds, and lean (low-fat) meats and poultry.

- **Limit foods with unhealthy additives** such as added sugars and saturated fats.

- **Say “yes” to fruits and vegetables.** Research shows that [eating five servings of fruits and vegetables every day can reduce your risk of some chronic diseases.](#)

- **Watch your portion size.** Keep an eye on how much you are eating and talk to your doctor about how many calories are right for you and your lifestyle.

A Mediterranean-style diet—which includes nuts, vegetables, and fish—is one example of a diet that is good for heart health and [may support the brain’s ability to think and remember.](#)

Prioritize your physical health

Small changes add up. Start today for greater health benefits later in life.

- **Drink less alcohol.** Alcohol can contribute to health problems, especially as you get older. If you drink, try sticking to one drink a day or less, or stop drinking altogether.
- **Prioritize sleep.** Aim for seven to nine hours of sleep each night. A bedtime routine and a regular sleep schedule can help develop good sleep hygiene.
- **Quit smoking and tobacco use.** If you use tobacco, dropping the habit now will help you feel better right away and can add years to your life, even if you’ve been smoking for a long time.
- **Keep up on your health care.** Make sure to get regular checkups and stay up to date on your health screenings and vaccinations.

Hobbies are fun, and they’re also an important part of healthy aging. Research shows that **older adults who engage in personally meaningful activities live longer**, are less likely to develop certain diseases, and are happier, less depressed, and more resilient.

SOURCE: National Institute on Aging

Care for your mental health

- **Keep your stress in check.** Chronic stress can damage the brain and body, including the parts of the brain involved with learning and memory. Strategies like getting regular exercise, meditating, and connecting with friends and family can help you manage stress.
- **Speak up if you feel down.** If you're struggling with mental health, don't be afraid to reach out. [Help is available!](#)

Nurture your relationships

No matter your age, feeling lonely and socially isolated can be harmful to your physical, emotional, and cognitive health. Developing and maintaining strong social ties can help you feel more engaged and connected. Try:

- **Volunteering** for a local organization.
- **Scheduling regular check-ins** with friends and family who live far away.
- **Connecting with other people in your community.** Get to know your neighbors or join a local club.

Engage your mind

Exercising your brain is just as important as exercising your body. Activities that challenge your brain on a regular basis keep your mind active and healthy and may help slow cognitive decline as you get older. Try:

- **Learning something new** like a new skill, language, or game.
- **Getting out and about**—you could visit a museum or try an exercise class.
- **Spending time on your hobbies**—for example, reading a book, playing the guitar, or cooking a nourishing meal.

Join a clinical study

Scientists are learning new things about the aging process and the best ways to support health, well-being, and healthy aging throughout life. Participating in a clinical research study is a great way to contribute to the scientific process and improve lives. [Find out more about clinical research and how to volunteer for studies.](#) ■



What we know about the science of healthy aging

Every day, NIH-funded scientists are making discoveries about aging process, age-related diseases and conditions, and ways to help people live longer, healthier lives.

[What Do We Know About Healthy Aging?](#) is a free booklet from the National Institute on Aging (NIA) that breaks down the science of healthy aging and provides steps you can take today to optimize your health as you grow older.

[What Do We Know About Healthy Aging?](#) is available as a PDF download or paper publication that you can share with friends and loved ones. ■



Use NIA's resources to spread the word about the harmful effects of social isolation and loneliness and to share strategies for staying connected.

STAY CONNECTED:

Tips from the National Institute on Aging for combating social isolation and loneliness

1 in 3 adults ages 45 and older feel lonely, and **1 in 4** ages 65 and older are socially isolated.

SOURCE: National Academies of Sciences, Engineering, and Medicine

Ways to stay connected include:

- **Checking in regularly** with family and friends via phone, email, or video chat
- **Meeting other people** with shared interests
- **Trying a new activity** or revisiting an old hobby
- **Getting involved** in the community

Have you ever felt lonely in a busy supermarket or a crowded party? While we all feel lonely sometimes, social ties are important for everyone. Strong connections are particularly important for the health and well-being of older adults.

Loneliness and social isolation aren't the same thing, but they are related. Loneliness is a feeling of emotional pain about being alone or separated from other people (even if we're not physically alone). Social isolation results from not having many social contacts or people to interact with, which can lead to feeling very lonely.

As people age, they often find themselves spending more time alone. Certain things can put older adults at a higher risk for social isolation and loneliness. These include living alone, having limited mobility or no reliable way to get around, financial struggles, language barriers, and caregiving duties. Physical distancing during the COVID-19 pandemic also made it harder to see family and friends in person.

One in four adults ages 65 and older are socially isolated, and research shows that this can take a toll on overall health and well-being. Loneliness and social isolation have been linked to conditions such as heart disease, high blood pressure, anxiety, depression, and cognitive decline.

To address this challenge, the National Institute on Aging (NIA) has tips to help older adults stay connected.

Check out NIA's [Loneliness and Social Isolation—Tips for Staying Connected](#) (also available in [Spanish](#)) for more information and resources to help you and your loved ones stay in touch.

You can also spread the word online with NIA's [Social Isolation and Loneliness Outreach Toolkit](#).

With these tools and resources at your fingertips, you can join the fight against loneliness and social isolation and support older adults in your family, community, and beyond in building and maintaining strong social connections. ■

Meet the Director:



National Institute of
Biomedical Imaging
and Bioengineering



Bruce J. Tromberg, Ph.D.

Bruce J. Tromberg, Ph.D., has been the Director of the National Institute of Biomedical Imaging and Bioengineering (NIBIB) since January 2019. Dr. Tromberg uses the science of optics and photonics (light and light-based technologies) to develop new techniques for biomedical imaging and therapy. Dr. Tromberg spoke with NIH MedlinePlus Magazine in early 2020, and now he's sitting down with us again to talk about his love of lasers, the light-speed advances in optics and photonics he's witnessed and contributed to throughout his career, and the unique role that NIBIB has played in NIH's COVID-19 response.

What drew you to optic and photonic technologies?

I first became interested in lasers and optics in the 1970s when I was an undergrad. Lasers were pretty new at the time, and I thought they were really cool. Here was something that didn't happen in nature, and you could blow stuff up with them!

I was obsessed with optics and photonics—what is light? How do you create it? How do you make it so intense that it can blow things up or burn a hole through things or measure the presence of something with a high degree of accuracy? One of the first things that people did with lasers was measure how far the moon really is from the Earth. You can just shine a laser and bounce it off the moon, and you can do some pretty cool calculations.

Laser technology is one of the most transformative inventions and an incredibly fast-moving area of science. No one knew how laser lights would be used when they were first invented. Scientists had predicted how they could work in theory, but it took decades to happen. Fast forward to today and, thanks to advances in computing and optics and photonics technologies, lasers have gone from a relatively rare, specialized technology to something that's deeply embedded in our daily lives. They have completely changed how we communicate and how we transfer information from place to place. Without lasers, we wouldn't have video chat, the internet, or technologies like LEDs and digital cameras.

How did your work in optics and photonics lead you to biomedicine and biomedical engineering?

I was lucky to be in the right place at the right time, in a field that was growing, and using a technology that was changing quickly. I came in with lasers, optics, and fiber optics (which take light from one place to another), but my gateway to biology was in cancer at the National Cancer Institute's biomedical imaging program. Cancer was one of the first areas [in medicine] to really embrace imaging technology development.

I also got involved in other areas of medicine—cardiovascular disease, neuroscience, metabolic disease, sports medicine—because a biomedical engineering perspective sees the body as an interconnected system made up of fundamental elements. We don't look at them in isolation.

We could adapt these technologies for medicine and biology—microscopes, imaging, therapies—but in the early days, the commercial driver was the internet and telecommunication.

Computers were mechanical machines at first. As they became electronic and miniaturized, it opened the door for personal computers. The internet resolved how you get all these things to talk to one another. At the most fundamental level, most communication systems are driven by dots and dashes (think of Morse code). Lasers can send exquisitely short pulses of light at an incredibly

“I was lucky to be in the right place at the right time, in a field that was growing, and using a technology that was changing quickly.”

fast rate. This means you can stack a whole bunch of pulses, which allows you to fit hundreds of millions of conversations into a single fiber optic cable. And that’s how I think, so I started applying those same principles to cancer and looking at ways to selectively activate or deactivate different molecules in the body.

How are the fields of bioimaging and biomedical engineering evolving?

Imaging technologies like MRIs, CT scans, and ultrasounds are advancing in really cool ways. Thanks to optics and photonics, there has been a huge revolution in microscopes, cameras, and different optical techniques that allow for things like minimally invasive surgeries and diagnostic techniques. We can put a device inside you (called an endoscope) to diagnose disease and guide surgeries. We have something called exogenous contrast agents, which are molecules and particles that you can put inside the body intravenously to identify things like tumors or neurodegenerative diseases.

Nuclear imaging is another promising area of development. In the bioimaging and biomedical engineering field, we ask the kinds of questions that can make the impossible, possible. I think many people would love to get into a scanner once a year just to know, “Am I getting Alzheimer’s? Do I have a tumor?” As nuclear imaging technology advances and becomes safer, we hope this will become possible.

I think people sometimes take these things for granted. But the blue LED, for example, took decades to develop and enabled a new generation of bright, energy-efficient white light bulbs and color LED screens. The scientists who developed it had to put atoms together in a lattice structure, which does not exist in nature, and they won a Nobel prize. So that’s the basis of a lot of this stuff. You put things together that are just not natural. And I’ve lived through and been fortunate to contribute to some of these advances in the biomedical space.



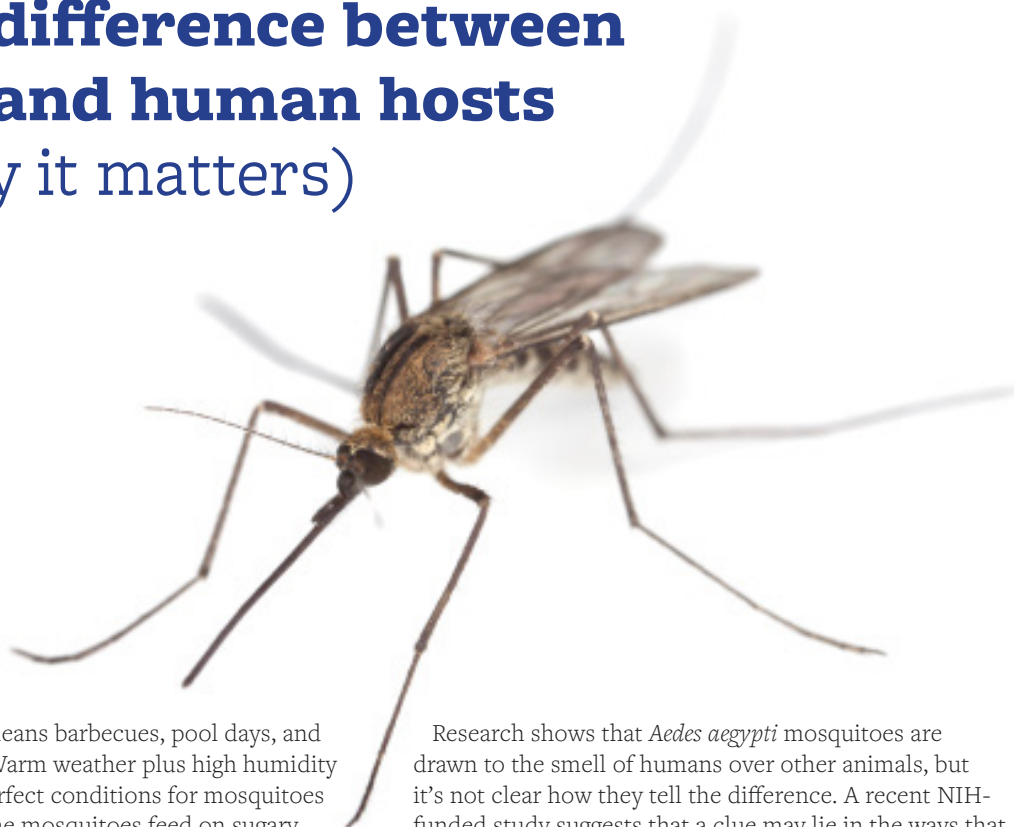
NIBIB Director Bruce J. Tromberg, Ph.D. left, and Senator Roy Blunt (Missouri).

What is NIBIB, and what is its role within NIH?

NIBIB is a home for the people who are developing the kinds of technologies that are not primarily driven by biological hypotheses. It has a fascinating origin story: In the 1990s, bioengineering was such a fast-moving field that Congress commissioned a study to assess its activities and impacts across both the country and NIH. Based on that study, an external panel recommended that NIH form a separate institute dedicated specifically to bioengineering. Instead, NIH wanted to weave bioengineering throughout the other institutes. Then a miracle occurred, and in 2000, President Clinton signed the [National Institute of Biomedical Imaging and Bioengineering Establishment Act](#), which required NIH to establish a separate institute focused on bioengineering.

To learn more about how the pandemic is guiding NIBIB research, and its plan to diversify the biomedical engineering workforce, check out Dr. Tromberg’s full interview online at [NIH MedlinePlus Magazine](#)! ■

How **mosquitoes** tell the difference between animal and human hosts (and why it matters)



Summertime means barbecues, pool days, and mosquitoes. Warm weather plus high humidity creates the perfect conditions for mosquitoes to thrive. Most of the time mosquitoes feed on sugary substances like plant nectars. However, when it's time for female mosquitoes to lay eggs, they need the extra protein that comes from blood supplies. Only female mosquitoes bite living hosts such as humans and other animals.

Mosquito bites can spread dangerous diseases such as malaria, dengue, Zika, and West Nile. While these diseases are more common in places like Africa, Asia, and South America, there have been cases in North America. Many of these diseases can also cause people to become more attractive to other mosquitoes, which helps the diseases to spread even faster. The *Aedes aegypti* mosquito, one of the most common types of mosquitoes, is responsible for spreading most mosquito-borne viral illness. And lucky for us, this species is especially attracted to humans. NIH-funded research sheds new light on how mosquitoes select their hosts and why, which opens the door for new ways to protect human health.

Research shows that *Aedes aegypti* mosquitoes are drawn to the smell of humans over other animals, but it's not clear how they tell the difference. A recent NIH-funded study suggests that a clue may lie in the ways that mosquitoes' brains react to different kinds of smells.

To find a host, mosquitoes use a combination of chemical and physical cues such as vision, taste, heat, and smell. Both humans and animals breathe in oxygen and breathe out carbon dioxide, which mosquitoes can sense from more than 30 feet away. After detecting exhaled carbon dioxide, a mosquito follows the odor and begins to sense body heat from the host.

Mosquitoes have taste receptors on their feet as well as their tongue, so once it lands, the mosquito can taste the host even before it bites. Mosquitoes also have multiple smell (or "olfactory") receptors in different locations: the antennae, the maxillary palp (near the mouth), and the proboscis (a mouth-like tube that helps the insect drink). These receptors connect to specific parts of the mosquito brain called "glomeruli," which respond to different kinds of smells.

There are **over 3,500** types of mosquitoes.

SOURCE: Centers for Disease Control and Prevention

So how do mosquitoes sniff out human hosts? A team of NIH-funded researchers tested different odors that mosquitoes are drawn to—including humans, rats, guinea pigs, dog hair, and milkweed flowers—and found that each one activated different combinations of glomeruli in the mosquitoes' brains: One glomeruli responded only to animal odors, another to only human odors, and a third to both animal and human odors.

Next, the research team took a closer look at the specific chemical compounds in the odors that lit up the “human-detecting” glomeruli and narrowed in on a substance called “sebum,” an oily and somewhat waxy substance made by skin and hair follicles that coats and protects the skin from harm.

This sebum combines with sweat and slowly evaporates into the air, which affects the way we smell—our “odor.” Our odor is a complex blend of chemicals that can act as a form of communication within and across species, so when we sweat or are in a humid environment, we're communicating with others that we're around... and that includes mosquitoes.

Dr. Carolyn S. McBride, one of the lead researchers on the study, said that breakdown products of human sebum likely trigger the “human-detecting” glomeruli of the *Aedes aegypti* mosquitoes that her team studied. Humans aren't the only animals that produce sebum, but its specific makeup varies across different species. Some humans create more sebum than others, and your sebum production can be influenced by factors such as age, medications, and lifestyle.

With nearly half of the world's population at risk of preventable mosquito-borne illnesses, a better understanding of how mosquitoes are attracted to their hosts—and how they tell the difference between animals and humans—can help researchers design more effective strategies for reducing the spread of dangerous diseases. ■



Mosquitoes use a combination of chemical and physical cues to sniff out their hosts.



Michael F. Chiang, M.D.

National Eye Institute (NEI) Director Michael F. Chiang, M.D., started his position during a strange time: In November 2020, protests over racial inequality continued across the country, and the nation was buckling down for the winter COVID-19 wave that would disproportionately affect people of color. Dr. Chiang has worked tirelessly to meet the needs of our community by reorganizing NEI's mission and strategy to ensure the institute's research is accessible to those who need it most. NIH MedlinePlus Magazine chatted with him to see how things have changed almost two years into the job.

You've been a big advocate for DEIA (diversity, equity, inclusion, and accessibility) at NIH. What drives your passion for that?

My parents moved to this country from Taiwan in the late 1960s, a few years before I was born. I was born in Pittsburgh, and when I was two, we moved to Detroit because my dad got a job at Ford Motor Company. I basically spent all the formative years of my childhood in Michigan, which at that time was not a place where there were many people who looked like me.

When I trained in ophthalmology in the late 1990s and early 2000s, there were barely any ophthalmology faculty who were of Asian descent. That's changing now, but it really gave me an appreciation for the significance of having role models and having people who look like you in supervisory or leadership positions.

I want to be able to do that, especially for younger people who come from different backgrounds, and that's going to require some work in the world that we live in. I think we're making progress on that compared to when I was younger, but I feel there's a lot more that we can do with this.

What are some efforts along those lines that you'd like to see implemented at NIH or elsewhere?

I think this pandemic has exposed that we have a lot of health care disparities in the United States and that there are pockets in this country, in both urban and rural areas, that are really medically underserved. We can do the best science in the world, but if it doesn't get to the people who need it the most, it's not nearly as useful.

There are many diseases in this country that disproportionately affect certain populations that are the most medically underserved. For example, glaucoma disproportionately affects Black and Hispanic patients. From a delivery-of-care perspective, it's important to have people in the health care system who the patients can truly relate to.

From a scientific perspective, we often talk about how important it is to do interdisciplinary work, where people with different academic backgrounds work with each other to think outside the box and come up with insights they wouldn't have had on their own. I think one aspect of this that's often underappreciated is that people who come from different personal backgrounds have different views of the world, so it's so important to have a diverse group of people who work together on these projects and contribute new ideas.

“At NEI, the research we do is not solely intended to publish papers or to fight diseases; we’re ultimately trying to fight for the people who have those diseases and improve their lives.”

You’ve made those changes a cornerstone of NEI through a new mission statement. How did that change?

When I started this position, looking carefully at our mission was one of the first things I did. I used to think mission statements were tools used by bureaucrats and bean counters, but I’ve seen firsthand the impact they can make in an organization when you use them to create a North Star.

Our mission statement had not changed since NEI began in 1968. It had to do with protecting and prolonging vision and with managing the special needs of people who have visual impairments. We spent months looking at this with stakeholders within and outside of NEI, and we came up with our [new mission: to eliminate vision loss and improve quality of life through vision research](#).

Vision is so important to people. Surveys have shown that people are really afraid of becoming blind. This is extremely stressful and a source of anxiety and depression in many patients. Vision is one of the primary ways we experience the world; it’s a major gateway to human emotion. And every single one of us will develop a vision problem, including refractive error [which makes it hard to see clearly] and cataracts, if we live long enough.

I think it’s really important to emphasize that at NEI, the research we do is not solely intended to publish papers or to fight diseases; we’re ultimately trying to fight for the people who have those diseases and improve their lives. That is why our mission statement includes “*improve quality of life*.” As people are living longer, I think it’s more important than ever to focus on quality of life.

We have four bullet points about how exactly we’re going to achieve our mission: drive innovative research; foster collaborations; recruit, inspire, and train talented and diverse individuals; and educate people about what we do and why it’s important.



NEI Director
Michael Chiang,
M.D., center, with
NEI trainees

Why do you think NEI’s research is important for our modern society when there have been so many improvements in vision treatment?

Many Americans need eyeglasses; refractive error is one of the most basic things that can go wrong with vision. But the diseases that can blind people—things like cataracts, macular degeneration, glaucoma, and diabetic eye disease—those things aren’t as easily reversible, and the risk of those diseases increases exponentially as people get older. This is an enormous public health problem as our entire population gets older.

Vision research also has made a really tremendous scientific impact in regard to methodological research, which we can apply to other parts of the body and other fields. For example, the first self-driving artificial intelligence system in medicine was for diabetic eye disease because there’s so much data we can gather when studying the eye compared to other systems. The first gene therapy approved by the Food and Drug Administration (FDA) for an inherited disease [a disease that’s passed down from parent to child] was for a retinal degeneration [an eye disease that causes the retina to break down] that causes babies to go blind because you can analyze and deliver those therapies very precisely in the eye.

To learn more about how NEI research works for our modern society, how Dr. Chiang’s experience in Silicon Valley led him to NIH, and his favorite activities both on and off the clock, check out his full interview online at [NIH MedlinePlus Magazine!](#) ■

60 years of innovation: NICHD research through the years

A glance at NICHD research contributions and achievements since 1962

Since 1962, the Eunice Kennedy Shriver National Institute of Child Health and Human Development (NICHD) has helped save lives and improve the well-being of people most often excluded from research. These include women, children, and people with disabilities. For its 60th anniversary, NICHD recognized some of its research accomplishments and looked to the future of health research.

Promoting healthy pregnancies

Understanding pregnancy has long been a focus for NICHD. Events before and during pregnancy can affect later health. In 1968, the institute began leading federal research on population and reproductive health. Their discovery of the earliest biomarker of pregnancy in 1978 led to the first home pregnancy test.

In 1982, an NICHD researcher discovered a possible mechanism for fetal alcohol syndrome. NICHD-funded research confirmed that alcohol intake during pregnancy could lead to intellectual disabilities in infants. These and other data led to the U.S. Surgeon General's warning about the risks of drinking alcohol during pregnancy. This warning still appears on alcoholic beverages today.

In 1994, research co-funded by NICHD showed that taking a medication regimen during pregnancy reduced the risk of perinatal (or before birth) HIV transmission. As a result of this and other HIV research, the perinatal HIV transmission rate is less than 1% in the United States today. NICHD continues to explore pre-pregnancy, prenatal, and postpartum health. The institute aims to reduce maternal morbidity and mortality and improve maternal health.

Raising healthy children

Understanding human development is key to ensuring the health and well-being of infants, children, and teens. Shortly after its founding, NICHD pioneered newborn screening by confirming the safety and efficacy of a blood-spot test for detecting phenylketonuria (PKU). This metabolic disorder causes intellectual disability if untreated. Today, more than 4 million infants are screened annually for dozens of conditions. This way, treatment can start early and often before symptoms arise.

NICHD and other organizations launched the Back to Sleep® campaign (now Safe to Sleep®) in 1994. The campaign raised awareness about reducing the risk of sudden infant death syndrome (SIDS) and sleep-related infant death. This and other



NICHD supports and conducts research to help save lives and promote well-being.

efforts helped reduce rates of sudden unexpected infant death, which includes SIDS, by almost 50%.

Using imaging technology, NICHD-funded researchers discovered the brain regions that contribute to dyslexia. This learning disorder makes reading difficult. Follow-up work showed that the right instruction changes brain structure. This helps the brain read more efficiently, even for people with reading difficulties. NICHD continues to explore human development and improve health throughout childhood and adolescence.

Ensuring healthy and optimal lives

NICHD-supported research has increased understanding of and helped reduce the effects of disease and disability:

- Dietary treatment initiated shortly after birth eliminated intellectual disability from PKU.
- Researchers discovered the genetic cause of Fragile X syndrome. It is the most common inherited form of intellectual disability, and an entirely new mechanism of genetic inheritance.
- Autism Centers of Excellence research identified distinct early brain development patterns in children who were later diagnosed with autism.

This background in ensuring healthy and optimal lives also enabled NICHD to address the COVID-19 pandemic. As the virus surged across the world, the institute focused on groups with unique health needs. Scientists studied SARS CoV-2 infection, transmission, and treatment in pregnant and lactating people, children, and those with disabilities. They also studied how to keep children in school safely.

Looking ahead

The past and future successes of NICHD rely on its people. As the biomedical research landscape changes, so will NICHD's strategies to bring in the best and brightest scientists and researchers. Ensuring a diverse workforce is important. NICHD and NIH are adapting so that the current and next generations of researchers and staff can thrive.

As NICHD embarks on its next 60-plus years, it will continue to build on the fundamental pillars of its mission—healthy pregnancies and children. ■

NIH is here to help

The National Institutes of Health (NIH)—the nation’s medical research agency—includes 27 Institutes and Centers and is a part of the U.S. Department of Health and Human Services. It is the primary federal agency for conducting and supporting basic, clinical, and translational medical research, and it investigates the causes, treatments, and cures for both common and rare diseases. For more information about NIH and its programs, visit www.nih.gov.

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Institutes

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National Eye Institute (NEI)

www.nei.nih.gov

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National Heart, Lung, and Blood Institute (NHLBI)

www.nhlbi.nih.gov

301-592-8573

National Human Genome Research Institute (NHGRI)

www.genome.gov

301-402-0911

National Institute on Aging (NIA)

www.nia.nih.gov

Aging information: 800-222-2225

Alzheimer’s information: 800-438-4380

National Institute on Alcohol Abuse and Alcoholism (NIAAA)

www.niaaa.nih.gov

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National Institute of Allergy and Infectious Diseases (NIAID)

www.niaid.nih.gov

301-496-5717

National Institute of Arthritis and Musculoskeletal and Skin Diseases (NIAMS)

www.niams.nih.gov

877-226-4267

National Institute of Biomedical Imaging and Bioengineering (NIBIB)

www.nibib.nih.gov

301-451-6772

Eunice Kennedy Shriver National Institute of Child Health and Human Development (NICHD)

www.nichd.nih.gov

800-370-2943

National Institute on Deafness and Other Communication Disorders (NIDCD)

www.nidcd.nih.gov

Voice: 800-241-1044

TTY: 800-241-1055

National Institute of Dental and Craniofacial Research (NIDCR)

www.nidcr.nih.gov

301-480-4098

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National Institute on Minority Health and Health Disparities (NIMHD)

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www.oar.nih.gov

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www.obssr.od.nih.gov

301-402-1146

Office of Communications & Public Liaison (OCPL)

[www.nih.gov/institutes-nih/nih-office-director/](http://www.nih.gov/institutes-nih/nih-office-director/office-communications-public-liaison)

office-communications-public-liaison

301-496-5787

Office of Rare Diseases Research (ORDR)

www.rarediseases.info.nih.gov

Genetic and Rare Disease

Information Center:

888-205-2311

Office of Research on Women’s Health (ORWH)

orwh.od.nih.gov

301-402-1770

What if the “happiest time of your life” doesn’t feel so happy?

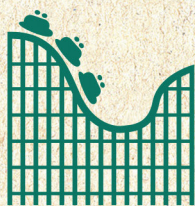


It seems like everywhere you look, you see happy moms. But the truth is, pregnancy and childbirth can bring a mix of emotions, including feeling sad and feeling overwhelmed. Many women may experience these emotions, which may be signs of depression and anxiety, before and after birth.

Contact a health care provider if you experience:



Intense anger,
worry, or
unhappiness



Extreme
mood swings



Difficulty caring
for yourself
or your baby



Less interest
in things you
used to enjoy



Changes in your eating or sleeping habits

Reach out if you don't feel right.

To learn more, visit nichd.nih.gov/MaternalMentalHealth.

Or call the National Maternal Mental Health Hotline at 1-833-943-5746 (1-833-9-HELP4MOMS).



Eunice Kennedy Shriver National Institute
of Child Health and Human Development